

include all of the features of the base claim and any intervening claims. Accordingly, claim 5 has been rewritten herein to be in independent format and to include all of the features of base claim 1 and intervening claim 3, thereby placing claim 5 in condition for allowance.

Drawings

Drawing Figures 13-18 are objected to because only that which is old is illustrated. Accordingly, enclosed herein is a Request for Approval of Drawing Corrections, along with drawing Figures 13-18 which have been amended to include a -- Related Art-- legend. Withdrawal of the objection is respectfully requested.

Specification

The Specification is objected to for informalities. The Specification is amended to be responsive to the objection. Withdrawal of the objection is respectfully requested.

Claims 1-4 and 6 Recite Patentable Subject Matter

Claims 1 and 3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,401,036 to Basu. Applicant respectfully traverses the rejection.

Pending claim 1 recites a brush seal device mounted to one of two parts that move relative to each other with a gap therebetween, for sealing the gap between the parts. The brush seal device includes a brush seal formed from bristles arranged into a wall shape, and including an attachment portion formed by connecting the bristles together at one end, and a free end face facing an opposing surface of the other part. A back plate is connected to the attachment portion of the brush seal and includes a support surface for supporting a side surface of the brush seal, the support surface having an annular projection extending therefrom. The back plate further includes a

recess that accommodates a bended portion of the bristles resulting from a differential pressure. A retaining plate retains the attachment portion of the brush seal between the retaining plate and the back plate. The support surface of the back plate and an opposing surface of the brush seal are disposed at a distance from each other. The bristle of the brush seal has a diameter of 0.15 mm to 0.008 mm.

In accordance with the present invention recited by pending claim 1, the bristles of the brush seal device are bent due to a relatively high differential pressure. The bent portions of the bristles are accommodated within the recess so that the inner diameter of the bristles is enlarged. For example, in a rotary machine such as a gas turbine engine, the differential pressure increases as the rotating speed increases. During normal operation, the outer diameter size of the rotor increases due to the centrifugal force of the rotor. In the present invention recited by pending claim 1, the inner diameter of the bristles can be increased due to the high differential pressure in accordance with the rotation of the rotor so that the abrasion of the bristles is effectively prevented.

Basu discloses a brush seal device having bristles disposed at a distance from a contact surface of a back plate. As a result, a force pressing the bristles against the back plate due to a differential pressure is weakened because of the rigidity bristles themselves and the ability of the bristles for following the deflection of the rotor in a radial direction is improved. However, Basu does not disclose a recess for accommodating a bent portion of the bristles and a projection of the support surface of the back plate.

As noted above, in the invention recited by pending claim 1, the inner diameter of the bristles can be increased due to a high differential pressure in accordance with the rotation of the rotor so that the abrasion of the bristles is effectively prevented. Basu does not disclose or suggest structure the can provide such an effect.

As stated in M.P.E.P. §2143.03, to establish *prima facie* obviousness of a claimed invention, all the claim features must be taught or suggested by the applied art of record. See *In re Royka*, 490 F.2d 981 (CCPA 1974). As Basu fails to teach or suggest all of the features recited by pending claim 1, Applicant respectfully submits the Office Action has not established *prima facie* obviousness. Therefore, Applicant respectfully submits that claim 1 is not rendered obvious in view of Basu. As such, Applicant respectfully submits pending claim 1 should be deemed allowable.

Claims 2-4 and 6 depend from claim 1. It is respectfully submitted that these four (4) dependent claims be deemed allowable for the same reasons claim 1 is allowable, as well as for the additional subject matter recited therein.

Withdrawal of the rejection is respectfully requested.

Claims 2 and 4 are rejected under 35 U.S.C. § 103(a) as being anticipated by Basu in view of U.S. Patent Number 5,799,952 to Morrison et al. (hereinafter “Morrison”). Applicant respectfully traverses the rejection.

Basu is discussed above.

Morrison merely discloses a brush seal device having bristles, a recess, and a projection formed on a contact surface of a contact plate, wherein a high pressure is introduced into the recess. As a result, a force pressing the bristles against the back plate due to a differential pressure is weakened and the ability of the bristles for

following the deflection of the rotor in a radial direction is improved. Furthermore, Applicant respectfully notes the brush seal device disclosed by Morrison requires a hole (or orifice) to introduce the high pressure.

Also, Morrison does not disclose a recess for accommodating a bent portion of the bristles due to a differential pressure.

In accordance with the present invention recited by pending claim 1, the bristles of the brush seal device are bent due to a relatively high differential pressure. The bent portions of the bristles are accommodated within the recess so that the inner diameter of the bristles is enlarged. For example, in a rotary machine such as a gas turbine engine, the differential pressure increases as the rotating speed increases. During normal operation, the outer diameter size of the rotor increases due to the centrifugal force of the rotor. In the present invention recited by pending claim 1, the inner diameter of the bristles can be increased due to the high differential pressure in accordance with the rotation of the rotor so that the abrasion of the bristles is effectively prevented. Morrison does not disclose or suggest structure the can provide such an effect.

As stated in M.P.E.P. §2143.03, to establish *prima facie* obviousness of a claimed invention, all the claim features must be taught or suggested by the applied art of record. See *In re Royka*, 490 F.2d 981 (CCPA 1974). As Basu and Morrison, alone or in combination, fail to teach or suggest all of the features recited by pending claim 1, Applicant respectfully submits the Office Action has not established *prima facie* obviousness. Therefore, Applicant respectfully submits that claim 1 is not rendered

obvious in view of Basu alone, Morrison alone, or a combination of Basu and Morrison.

As such, Applicant respectfully submits pending claim 1 should be deemed allowable.

Claims 2-4 and 6 depend from claim 1. It is respectfully submitted that these four (4) dependent claims be deemed allowable for the same reasons claim 1 is allowable, as well as for the additional subject matter recited therein.

Withdrawal of the rejection is respectfully requested.

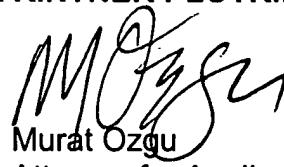
Conclusion

In view of the foregoing, reconsideration of the application, withdrawal of the outstanding objections and rejections, allowance of claims 1-6, and the prompt issuance of a Notice of Allowability are respectfully solicited.

Should the Examiner believe anything further is desirable in order to place this application in better condition for allowance, the Examiner is requested to contact the undersigned at the telephone number listed below.

In the event this paper is not considered to be timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300, **referencing attorney docket number 108179-00007.**

Respectfully submitted,  
**AREN'T FOX KINTNER PLOTKIN & KAHN PLLC**



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Enclosures: Marked Up Version of Specification as Amended  
Marked Up Version of Claims as Amended  
Request for Approval of Drawing Corrections  
Amended Drawing Figures 13-18  
Petition for Extension of Time (1 month)

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**Marked Up Version of Specification as Amended**

**IN THE SPECIFICATION:**

Please amend the paragraph on page 9, lines 2-4 of the Specification as follows:

Fig. 11 is a graph showing the relation between deflection and load applied to a [brash] brush seal of the present invention in the radial direction;

Please amend the paragraph on page 9, lines 11-13 of the Specification as follows:

Fig. 14 is a front view of a [brash] brush seal in the state where the rotating shaft of Fig. 11 does not swing;

Please amend the paragraph on page 9, lines 14-15 of the Specification as follows:

Fig. 15 is a front view of the [brash] brush seal pressed by the rotating shaft of Fig. 11;

Please amend the paragraph on page 9, lines 16-18 of the Specification as follows:

Fig. 16 is a cross-sectional view of the [brash] brush seal device of Fig. 11 being subjected to the pressure of a sealed fluid;

Please amend the paragraph on page 9, lines 22-25 of the Specification as follows:

Fig. 18 is a cross-sectional view of the [brash] brush seal device in which a gap C is produced by the rotating shaft moved in the opposite direction from the state of Fig. 14.

Please amend the paragraph on page 10, lines 7-10 of the Specification as follows:

Fig. 1 is a cross-sectional view of a brush seal device 1. The ~~brush~~ brush seal device 1 divides the gap between a casing 50 and a rotor 60 of a gas turbine into a high-pressure (P1) side and a low-pressure (P2) side.

Please amend the paragraph on page 10, lines 11-21 of the Specification as follows:

Referring to Fig. 1, the ~~brush~~ brush seal device 1 has a fixed portion 20 in its outer periphery, and a free end face 5 at its inner periphery. The fixed portion 20 is mounted in a groove 51 formed at the inner peripheral surface of one part (the casing 50). The free end face 5 faces the outer peripheral surface of the other part (the rotor 60). More specifically, the free end face 5 is in contact with, or in close proximity to, the outer peripheral surface of the rotor 60. The brush seal device 1 serves to seal a sealed fluid on the high-pressure (P1) side.

Please amend the paragraph bridging pages 10-11 of the Specification as follows:

The brush seal 2 is formed from bristles 4 disposed like a wall with a prescribed thickness. More specifically, the bristles 4 are tilted in the rotation direction of the rotor 60, and arranged into a wall shape in the circumferential direction. The bristles 4 are welded together at the outer periphery to form an attachment portion 3. The bristle 4 has a diameter of 0.2 mm to 0.005 mm, and preferably, 0.15mm to ~~0.08~~ 0.008 mm, and has a length of 5 mm to 50 mm. The wall thickness of the bristles 4 is preferably in the range of 0.5 mm to 5 mm.

**Marked Up Version of Claims 1-5 as Amended**

**IN THE CLAIMS:**

Please amend claims 1-5 as follows:

1. (Amended) A brush seal device mounted to one of two parts that move relative to each other with a gap therebetween, for sealing the gap between said parts, comprising:

    a brush seal formed from bristles arranged into a wall shape, and including an attachment portion formed by connecting said bristles together at one end, and a free end face facing an opposing surface of said other part;

    a back plate connected to said attachment portion of said brush seal, and including a support surface for supporting a side surface of said brush seal, said support surface having an annular projection extending therefrom, and said back plate further including a recess that accommodates a bended portion of said bristles resulting from a differential pressure; and

    a retaining plate for retaining said attachment portion of said brush seal between said retaining plate and said back plate, wherein

    said support surface of said back plate and an opposing surface of said brush seal are disposed at a distance from each other,

    and said bristle of said brush seal has a diameter of 0.15 mm to 0.008 mm.

2. (Amended) The brush seal device according to claim 1, wherein said [back plate includes a line-shaped] projection [at said support surface, which] extends along an arrangement direction of said bristles.

3. (Amended) The brush seal device according to claim 1, wherein said [back plate includes a] recess is formed along an arrangement direction of said bristles[, and said recess serves as said support surface].

4. (Amended) The brush seal device according to claim [3] 1, [wherein said recess has a line-shaped] further comprising another annular projection extending from an inner peripheral end of said support surface [along the arrangement direction of said bristles].

5. (Amended) [The] A brush seal device [according to claim 3] mounted to one of two parts that move relative to each other with a gap therebetween, for sealing the gap between said parts, comprising:

a brush seal formed from bristles arranged into a wall shape, and including an attachment portion formed by connecting said bristles together at one end, and a free end face facing an opposing surface of said other part;

a back plate connected to said attachment portion of said brush seal, and including a support surface for supporting a side surface of said brush seal; and

a retaining plate for retaining said attachment portion of said brush seal between said retaining plate and said back plate, wherein

said support surface of said back plate and an opposing surface of said brush seal are disposed at a distance from each other,

said bristle of said brush seal has a diameter of 0.15 mm to 0.008 mm,

wherein said back plate includes a recess formed along an arrangement direction of said bristles,

said recess serves as said support surface, wherein

said bristles of said brush seal are tilted from said attachment portion, and  
said support surface of said back plate or a side surface of said retaining plate  
facing said brush seal includes a resistance means for preventing said bristles from  
moving in such a direction as reduces their tilt angle.